

# Claims

- [c1] A method of controlling dopant diffusion comprising:  
forming a monolayer comprising carbon and oxygen on  
a first semiconductor layer; and  
forming a second semiconductor layer on said mono-  
layer, wherein one of said semiconductor layers contains  
dopants therein and said monolayer substantially retards  
diffusion of said dopants.
- [c2] The method of Claim 1 wherein said first semiconductor  
layer is subjected to a step in which a surface native ox-  
ide layer is removed prior to forming said monolayer.
- [c3] The method of Claim 2 wherein said surface native oxide  
layer is removed by a hydrofluoric acid-containing solu-  
tion.
- [c4] The method of Claim 1 wherein said first semiconductor  
layer is subjected to a hydrogen termination processing  
step prior to forming said monolayer.
- [c5] The method of Claim 4 wherein said hydrogen termina-  
tion processing step comprises contacting the first semi-  
conductor layer with hydrofluoric acid either in solution  
or in the gas phase.

- [c6] The method of Claim 4 wherein said hydrogen termination processing step comprises a hydrogen anneal.
- [c7] The method of Claim 1 wherein said dopants are n-type dopants or p-type dopants.
- [c8] The method of Claim 1 wherein said dopants are located in the first semiconductor layer.
- [c9] The method of Claim 1 wherein said dopants are located in the second semiconductor layer.
- [c10] The method of Claim 1 wherein said forming said monolayer comprises contacting the first semiconductor layer with a solution comprising iodine and an alcohol.
- [c11] The method of Claim 10 wherein said solution comprising iodine and an alcohol contains from about  $1 \times 10^{-3}$  to about  $1 \times 10^{-5}$  M of iodine in alcohol.
- [c12] The method of Claim 1 wherein said forming a second semiconductor layer comprises a deposition process that is performed at a temperature of about 500°C or greater.
- [c13] The method of Claim 1 further comprising annealing said first semiconductor layer, and said monolayer to activate said dopants, said anneal occurs prior to forming said second semiconductor layer.

- [c14] The method of Claim 10 wherein said alcohol comprises methanol.
- [c15] A method of controlling dopant diffusion comprising:  
forming a monolayer comprising carbon and oxygen on a first material layer; and  
forming an overlayer on said monolayer, wherein one of said first material layer or said overlayer contains dopants and said monolayer substantially retards diffusion of said dopants.
- [c16] The method of Claim 15 wherein said first material layer is a first semiconductor layer which is subjected to a step in which a surface native oxide layer is removed prior to forming said monolayer.
- [c17] The method of Claim 15 wherein said first material layer is subjected to a hydrogen termination processing step prior to forming said monolayer.
- [c18] The method of Claim 17 wherein said hydrogen termination processing step comprises contacting the first material layer with a hydrofluoric acid-containing solution, a gas phase containing hydrofluoric acid or a hydrogen anneal.
- [c19] The method of Claim 15 wherein said dopants are n-

type dopants or p-type dopants.

- [c20] The method of Claim 15 wherein said dopants are located in said first material layer.
- [c21] The method of Claim 15 wherein said dopants are located in said overlayer.
- [c22] The method of Claim 15 wherein said forming said monolayer comprises contacting the first material layer with a solution comprising iodine and an alcohol.
- [c23] The method of Claim 22 wherein said solution comprising iodine and an alcohol contains from about  $1 \times 10^{-3}$  to about  $1 \times 10^{-5}$  M of iodine in alcohol.
- [c24] The method of Claim 15 wherein said overlayer comprises a semiconductor material, an insulator, a conductor or any combination thereof.
- [c25] The method of Claim 15 wherein said forming the overlayer comprises a deposition process that is performed at a temperature of about 500°C or greater.
- [c26] The method of Claim 15 further comprising annealing said first material layer, said monolayer and said overlayer.
- [c27] The method of Claim 21 wherein said alcohol comprises

methanol.

- [c28] The method of Claim 15 wherein said first material layer comprises an insulator and the overlayer comprises a conductor.